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(54) Title: A PLANT FOR CASTING PIPES, IN PARTICULAR OF CONCRETE			
(57) Abstract			
<p>A plant for casting pipes comprising at least two stationary or vertically displaceable mould cores and at least two outer moulds with each their bottom ring to form the lower end portion of the pipes and for supporting this relative to the outer mould, and wherein the plant further comprises a support device for supporting and positioning each outer mould with its associated bottom ring in its casting position substantially concentrically with an associated mould core, and wherein the plant according to the invention further comprises a frame provided with coupling means for releasably mounting and mutually securing at least two outer moulds adjacently each other. Hereby a very flexible system is obtained and simultaneously effective utilisation of the plant capacity is obtained.</p>			

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A plant for casting pipes, in particular of concrete

The present invention relates to a plant for casting pipes comprising at least two stationary or vertically
5 displaceable mould cores, and at least two outer moulds each of which is provided with a bottom ring to form the lower extremity portion of the pipes and to support it relative to the outer mould, and wherein the plant fur-
10 ther comprises a support device for supporting and positioning each outer mould with its associated bottom ring in its casting position substantially concentrically with an associated mould core.

Such plants are known today in countless embodiments. One
15 example of this is known from WO A1 92 18 309 that features a plant with a vertically displaceable core and an outer mould with an associated bottom ring which may be removed as an assembly unit following casting of a pipe in the mould by pulling the core completely out of the
20 outer mould, following which the outer mould with the cast pipe can be moved as a unit.

It is a recurring problem associated with machinery for casting e.g. concrete pipes that it is desired to be able
25 to alternate quickly between the casting of pipes that are different with regard to e.g. pipe length, but in particular to alternate between pipes that are different with regard to cross sectional dimensions and cross sectional configurations. It is also desired that full use
30 is made of the capacity of the machinery in the casting of small as well as large pipes. These two development criteria are problematic since they are to a certain degree complementary, which means that in the development of a given machine it is an object to compromise so as to
35 take both criteria into account.

In the light of this it is the object of the present invention to provide an apparatus of the type described in the introductory part while taking, to a higher degree than the known machines, both the above-mentioned development criteria into consideration.

This is obtained by a plant as featured in claim 1. Since, in accordance with the invention, the plant thereby further comprises a frame provided with coupling means for releasable mounting and mutual attachment of at least two outer moulds adjacently each other, it is made possible to alternate between simultaneous production of pipes of the same or of different types and dimensions. Thus it is possible in one and the same machine to carry out production of two different pipe types, or of one and the same pipe type. This makes it possible in a flexible manner to adapt the production in such a manner that e.g. a relatively large pipe may be produced simultaneously with a relatively small pipe, whereby the total production is optimised relative to the remaining capacity of the plant.

According to a further preferred embodiment, the frame is configured with a view to arrangement and resting on the support device. Thereby the frame will be positioned between the support device and the outer moulds arranged in the frame whereby only the frame is to have a strength that ensures fixation of the two outer moulds relative to each other.

Moreover, the frame may advantageously be provided with at least two substantially identical sets of coupling means for receiving and securing each their outer mould, and the plant comprises outer moulds which each has a set of identical coupling means that are complementary relative to the identical set of coupling means of the frame.

Hereby it is ensured that it is possible to freely alternate between different outer moulds irrespective of their positioning in the frame. This ensures a higher degree of flexibility in the production switches between different
5 types of pipes.

Each of the identical sets of coupling means of the frame may advantageously comprise four identical sets of coupling devices that are preferably arranged in a rectangular or square pattern so as to allow a high degree of
10 freedom with regard to the orientation of the individual outer moulds in the frame.

If the frame is further provided with two lifting devices with a view to lifting and transporting the frame with
15 outer moulds mounted thereon, and if the outer moulds configured for mounting in the frame are so provided that the centres of gravity of the empty as well as the filled outer moulds are situated vertically below a straight
20 line that extends through the lifting devices, it follows that, irrespective of the type of mould arranged in the frame, lifting of the frame by means of e.g. a crane with two parallel lifting devices will bring about stable positioning of the centre of gravity of the frame with associated outer moulds whereby imbalance during lifting is
25 avoided.

Particularly advantageously the coupling means of the frame consist of simple conical supports for supportive
30 reception of the complementary coupling means on the outer moulds and thus by the outer moulds, and the complementary coupling means on the outer moulds are arranged completely above the centres of gravity for the filled as well as the empty outer moulds and preferably
35 at the upper end of the outer mould whereby the major part of each outer mould extends there below following

mounting in the frame. Thereby it is obtained that it is very expedient and simple to change outer moulds in the frame simultaneously with the outer moulds being suspended in the frame in a stable manner.

5

In this context, it is particularly advantageous if the complementary coupling means on each outer mould are so arranged that two adjacent outer moulds that are mounted in the frame and their associated bottom rings extend
10 equally below the frame. Thereby both outer moulds will, following lifting, be put down again, hit the support simultaneously thereby eliminating the risk of vibrations in the moulds in this process.

15 The support device may consist of a stationary framework configured for supporting only one frame, but alternatively it may also be in the form of a movable or rotatable device with a view to supporting a first and a second frame next to each other and in one and the same
20 plane, and the support device comprises means for alternately moving the first and the second frames with outer moulds mounted therein to their casting positions. In particular, the support device may be in the form of a carousel whereby it may, by rotation, alternately swing
25 the first and the second frames into their casting positions. Hereby it is obtained that, following filling of a first pair of moulds, another set of moulds may expediently be arranged in the casting position whereby the remaining capacity of the plant may be utilised to a maximum.
30

Obviously, in certain cases the plant may be used in particular for the casting of pipes with a very large diameter, in which it is practically possible to fill only one
35 pipe at a time. According to a particularly advantageous embodiment, the plant further comprises outer moulds

which have coupling means intended for arrangement thereof directly on the support device.

Moreover the support device is conveniently adjustable
5 with a view to receiving and securing frames and/or outer moulds of different sizes. As it is, this will mean that it is possible to provide an even more flexible adjustment of the equipment for the casting of different pipe types.

10

Preferred embodiments of the invention will now be described in further detail with reference to the drawings, wherein:

15 Figure 1 illustrates a plant according to the present invention, seen from above.

Figure 2 is a sectional view of the plant shown in Figure 1 along the section A-A in Figure 1.

20

Figure 3 is a front view of the support device shown in Figure 1 with the frame and two outer moulds mounted thereon.

25 Figure 4 shows the arrangement shown in Figure 3, seen from above.

Figure 5 is a perspective view illustrating the frame according to Figures 3 and 4 in which the outer moulds are
30 mounted.

Figure 6 illustrates the frame according to Figures 3 and 4 with outer moulds mounted thereon and wherein the frame is lifted off the support device.

35

Figure 7 is a top plan view of the support device shown in Figures 3 and 4, but without the frame and with only one outer mould.

- 5 Figure 8 illustrates the outer mould according to Figure 7 lifted off the support device.

Figure 9 is a lateral view of a plant according to the invention and in principle corresponding to the plant
10 shown in Figure 2 except for an alternative configuration of the support device.

Figure 10 illustrates the plant shown in Figure 10, seen from above.

15

Thus, Figure 1 is a top plan view of a plant for casting concrete pipes. The plant comprises a storage silo 1 for ready-mixed concrete and two conveyors 2,3 for transporting concrete from the storage silo 1 to two casting stations 4,5, comprising the parts necessary for transporting concrete from the conveyors 2,3 to the concrete pipe moulds, such as feeding funnels, and optionally pressing tools for pressing in loose top rings with a view to the final shaping of tapered ends on the cast concrete pipes
20 located in the concrete moulds.
25

In the embodiment shown the storage silo 1 is arranged to be stationary relative to the foundation of the machinery, and the two conveyors 2,3 with associated casting stations 4,5 are displaceably arranged on the guides 6,7
30 whereby the casting stations may be displaced forwards and backwards between the casting position shown in the figure in which the casting stations 4,5 extend across the pipe moulds and a retracted position in which the space above the pipe moulds is cleared.
35

Additionally a framework 8 is arranged for receiving and positioning one or two outer moulds for the casting process.

- 5 The invention is useful in connection with plants of other types than the one shown herein, but in the preferred embodiment, as shown, the plant is automated as regards processes concerning the supply of concrete to the moulds, positioning of the moulds at the casting stations, and casting of the individual pipes with subsequent finishing of the tapering ends by means of either top rings secured to the inside of the outer moulds, as is known from e.g. WO A1 92 18 309, or loose top rings inserted into the mould following casting of the pipe and subsequently pressed down into the outer mould to form the tapering end. The present invention is particularly advantageous in connection with plants in which the outer moulds with the cast pipes are removed by means of a transportation device intended therefor and are subsequently arranged at a location where the outer mould is released from the bottom ring and lifted upwards whereby the outer mould is lifted off the cast pipe which subsequently rests firmly on the bottom ring. The outer mould may subsequently be used in a renewed casting process whereby the number of outer moulds in a production process may be reduced considerably.

Turning now to Figure 2, the plant shown in Figure 1 is illustrated, only it is seen in a sectional, lateral view along line A-A in Figure 1.

It will also appear that, beneath each of the casting stations, the plant has a vertically displaceable lifting device 9 on which an inner core may be mounted which may be displaced upwards and into the outer mould and the bottom ring thereof during the casting process. Moreover,

it will appear that on the framework 8 a frame is located in which at least two outer moulds may be arranged which may be firmly secured relative to each other by means of the frame 10.

5

The plant shown in Figures 1 and 2 is illustrated without any moulding tools, since it was intended with these figures only to give an impression of the functioning of a plant of the preferred type.

10

Now, a study of Figures 3 and 4 will reveal the framework 8 as shown in Figures 1 and 2, seen from the front and from above, respectively, with the difference, however, that herein it is shown that the frame 10 is provided with two outer moulds 11 and 12 with associated bottom rings 13 and 14. Thus, the framework 8 consists of a number of stationary columns 15, 15a, 16, 16a and a beam 17 that extends between two columns 15a, 16a and forms a guide for a displaceable support device 18 which may be adjusted with a view to supporting frames or outer moulds with different dimensions.

On the columns 15, 15a, 16 and 16a and on the displaceable support device 18 a number of conical positioning pins are arranged that serve as guides for e.g. the frame 10 shown in Figures 3 and 4, in that the positioning pins support the frame 10 by insertion of the positioning pins into conical apertures intended therefor in the frame 10.

As will appear in particular from Figure 4, at the top each outer mould 11, 12 is provided with respective flanges 19, 20 which have substantially identical geometries at their periphery. Moreover, the flanges 19, 20 have conical apertures for receiving conical pins 21 on the frame 10 whereby the outer moulds 11, 12 may be lo-

cated on the frame 10 and rest thereon in a stable manner.

A detailed drawing of the frame 10 will now appear from
5 Figure 5 which shows that in the embodiment shown the frame has eight conical pins 21 and wherein said conical pins 21 are arranged in two groups each of which comprises four pins, and wherein the pins in each group are arranged at the corners of a rectangle. Moreover the
10 frame 10 is provided with a number of lifting eyes 22 for attachment of a lifting device. Thereby the frame 10 with the outer moulds mounted therein may be lifted without the frame 10 being tilted in the process.

15 Now, Figure 6 illustrates a frame 10 with outer moulds 11,12 mounted therein, said frame 10 with outer moulds 11,12 being lifted partially clear of a pair of cast pipes 23,24. Herein the frame 10 is lifted by a crane with two parallel extending lifting hooks 25,26 which are
20 secured to the lifting eyes 22 on the frame 10 by means of a pair of lifting straps.

Use of the frame 10 according to the invention thus allows alternating casting of different pipe geometries,
25 simply by changing the outer moulds in the frame 10. Moreover, pipes of different or like geometries may optionally be produced in the same casting process, and due to the fact that the outer moulds 11,12 rest substantially exclusively on the frame 10, the outer moulds
30 11,12 may be changed very quickly. Thus, it will appear from the figures that it is possible to cast pipes with large and small cross sections simultaneously whereby the moulds may be combined to ensure optimal utilisation of the plant capacity but also, if desired, with due regard
35 to "just-in-time" production.

In certain situations the plant according to the preferred embodiment may be used for casting pipes with very large cross sectional dimensions where it is not practically possible to cast two pipes simultaneously. Thus it is preferred that the plant further comprises a number of outer moulds 27 which are each provided, at their upper extremities, with a flange 28, as shown in Figures 7 and 8 thus allowing that the outer mould 27 alone may be arranged directly on the framework 8 without interposed frame.

In the preferred embodiment the frame 10 and the outer mould 27 is provided with corresponding conical apertures whereby the outer mould 27 may be arranged on the same conical pins as the frame. At the displaceable support 18 it is possible to vary between use and direct support of frames 10 and large outer moulds 27, or between frames and outer moulds of different dimensions.

Figure 8 illustrates in particular the outer mould according to Figure 7 which is lifted in lifting eyes and lifting straps intended therefor and wherein it is shown that the outer mould is lifted partially clear of a cast pipe 28 following arrangement of the latter on a bottom ring 29 on a support.

It is obvious that when using frames 10 according to the present invention, the plant shown in Figures 1 and 2 will provide an extremely high degree of flexibility in the casting of concrete pipes with a view to expedient change of outer moulds, and adaptation of the production with regard to pipe geometries and dimensions, in particular with regard to the pipe length, but in particular with a view to the cross sectional geometry.

In accordance with a further preferred embodiment the frame 10 according to i.a. Figures 1 and 2, however, is further replaced by a device for displacing frames 10 below and away from the casting station, respectively.

5 Thus, such preferred embodiment is illustrated in Figures 9 and 10 that show that a carousel 30 is arranged at the casting station for positioning and supporting two frames 10,10a, each of which may be provided with outer moulds.

10 As will appear, the carousel 30 is configured substantially in the form of two frameworks of the type shown in Figures 3 and 4 which are secured to each other, but which are rotatably secured about a vertical axis 31, and wherein a set of wheels 32 is also mounted at least at

15 the columns that are situated most distantly from the vertical axis of rotation 31.

Thereby two frames 10,10a may be located alternately below the casting station and away therefrom in a position

20 in which the frame 10a, as shown in Figure 9, may be lifted clear of the carousel 30 and to a place where the cast pipe is configured in the same manner as shown in Figure 6. Thereby the plant capacity is utilised to a maximum since it is hereby ensured that a frame 10 is always present below the casting position, thus reducing

25 the resting periods of the plant considerably.

Otherwise, the plant depicted in Figures 9 and 10 corresponds exactly to the plant depicted in Figures 1 and 2.

30

Obviously the present invention may be exercised in a variety of alternative ways besides the ones described above and in the figures. Thus, the frames may be configured to receive a larger number of outer moulds than the

35 two shown in the figure. Besides, the frames may have different dimensions with a view to receiving outer

moulds of other cross sections than those shown herein. With regard to the carousel shown in Figures 9 and 10, it may also be replaced by a device which is displaceable in the parallel direction which may also cause frames or
5 outer moulds to be moved to a position below and away from the casting station, respectively.

As regards outer moulds, only moulds for casting pipes with substantially circular cross sections are shown
10 herein. However, the present invention also lends itself for use in connection with other pipes with other geometries, such as egg-shaped, oval, square, etc. Obviously, in this connection it is of consequence that the outer moulds have such configurations that, when lifted in a
15 frame, their shared point of gravity will be situated vertically below the straight line which may be drawn between the lifting hooks.

It is also possible to configure frames for receiving
20 more than two outer moulds as shown in the drawings. In particular, the frames for receiving more than two outer moulds be so configured that the individual forms are not positioned along a straight line as shown in the figures, but optionally along the periphery of a circle or at the
25 corners of a square. In such embodiments a plurality of storage containers with associated conveyors and casting stations may advantageously be provided whereby a high degree of flexibility is obtained as regards the construction and dimensioning of the plant to a given capacity.
30

The use of frames with moulds that are not arranged along a circle advantageously allows for use of lifting devices which have more than two and preferably three or four
35 parallel-extending lifting hooks whereby it is ensured to

the highest degree possible that imbalance in the frame does not occur during lifting.

C l a i m s

1. A plant for casting pipes comprising at least two stationary or vertically displaceable mould cores, and at least two outer moulds with each their bottom ring to form the lower end portion of the pipe and for supporting this relative to the outer mould, and wherein the plant further comprises a support device for supporting and positioning each outer mould with its associated bottom ring in its casting position substantially concentrically with an associated mould core, c h a r a c - t e r i z e d in that the plant further comprises a frame provided with coupling means for releasably mounting and mutually securing at least two outer moulds adjacently each other.

2. A plant according to claim 1, c h a r a c - t e r i z e d in that the frame is configured with a view to being arranged on and resting on the support device.

3. A plant according to claim 1 or 2, c h a r a c - t e r i z e d in that the frame is provided with at least two substantially identical sets of coupling means for receiving and securing each their outer mould, and that the plant comprises outer moulds each of which has a set of identical coupling means which is complementary relative to the identical set of coupling means of the frame.

4. A plant according to claim 3, c h a r a c - t e r i z e d in that each of the identical sets of coupling means of the frame comprises four identical coupling devices, preferably arranged in a rectangular or square pattern.

5. A plant according to any one of the preceding claims, c h a r a c t e r i z e d in that the frame is provided with two lifting devices intended for lifting and transporting the frame with its outer moulds mounted thereon, and that the outer moulds for mounting in the frame are so configured that the points of gravity for the empty as well as the filled outer moulds are situated vertically below a straight line that extends through the lifting devices.
6. A plant according to any one of the preceding claims, c h a r a c t e r i z e d in that the coupling means of the frame consist of simple conical supports for supportingly receiving the complementary coupling means on the outer moulds, and thus the outer moulds, and that the complementary coupling means on the outer moulds are arranged completely above the points of gravity for the filled as well as the empty outer moulds, and preferably at the upper extremity of the outer mould, whereby the major part of each outer mould extends there below following mounting in the frame.
7. A plant according to claim 6, c h a r a c - t e r i z e d in that the complementary coupling means on each outer mould are so arranged that two outer moulds arranged adjacently each other and mounted in the frame and their associated bottom rings extend equally below the frame.
8. A plant according to one of the preceding claims, c h a r a c t e r i z e d in that the support device is constituted of a stationarily arranged framework.
9. A plant according to any one of the preceding claims, c h a r a c t e r i z e d in that the sup-

port device is configured with a view to supporting a first and a second frame next to each other and in one and the same plane, and that the support device comprises means for alternately moving the outer moulds mounted in
5 the first and the second frames therein to their casting positions.

10. A plant according to claim 9, c h a r a c -
t e r i z e d in that the support device is in the
10 form of a carousel whereby it may, by rotation, alternately pivot the first and the second frames into their casting positions.

11. A plant according to any one of the preceding
15 claims, c h a r a c t e r i z e d in that the plant further comprises outer moulds which have coupling means with a view to positioning them directly on the support device.

20 12. A plant according to any one of the preceding claims, c h a r a c t e r i z e d in that the support device is adjustable with a view to receiving and securing frames and/or outer moulds of different sizes.

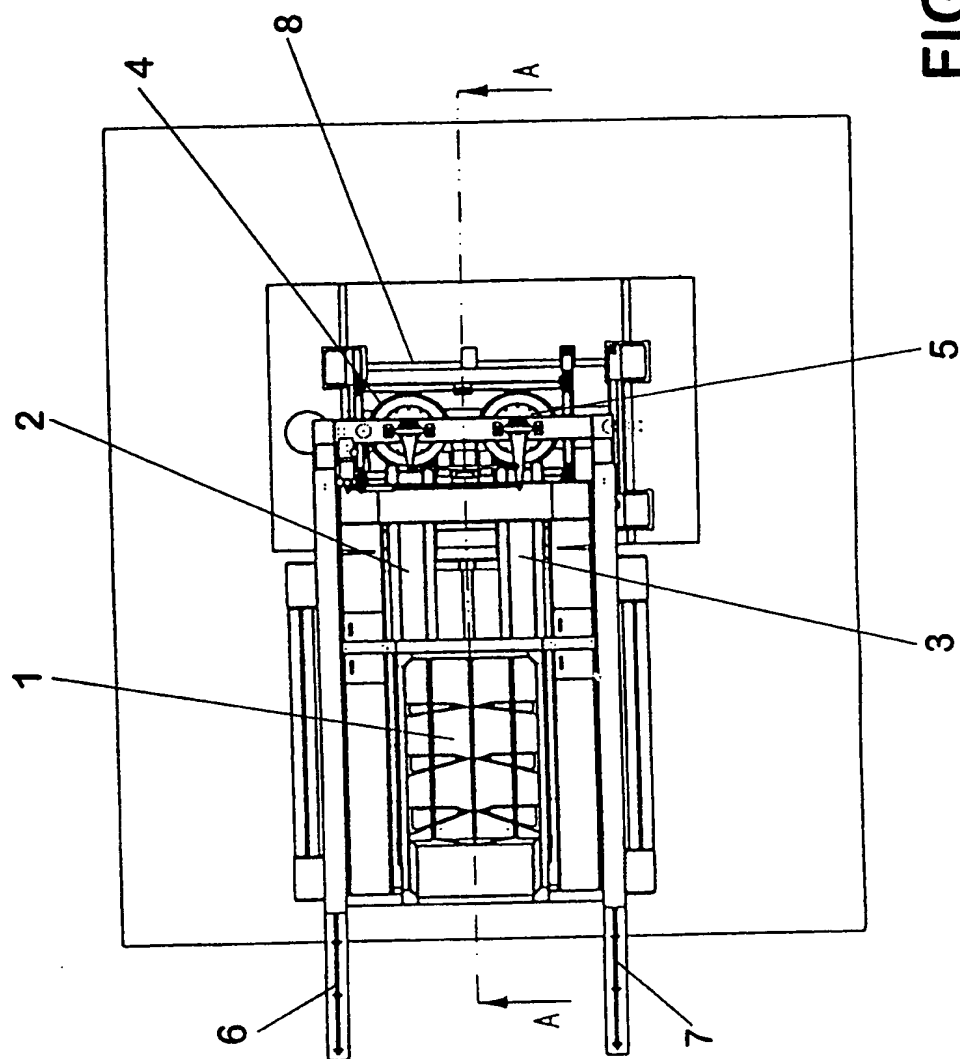
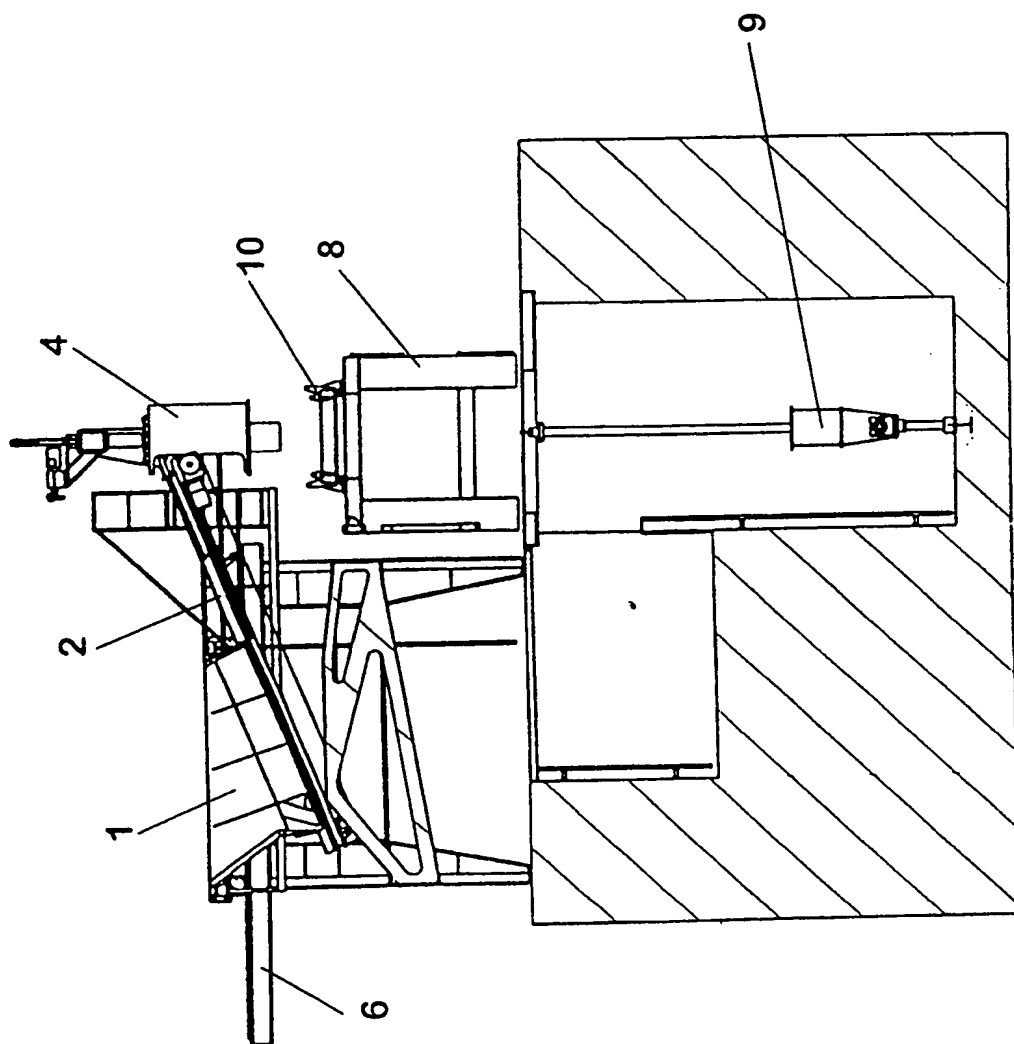


FIG. 1



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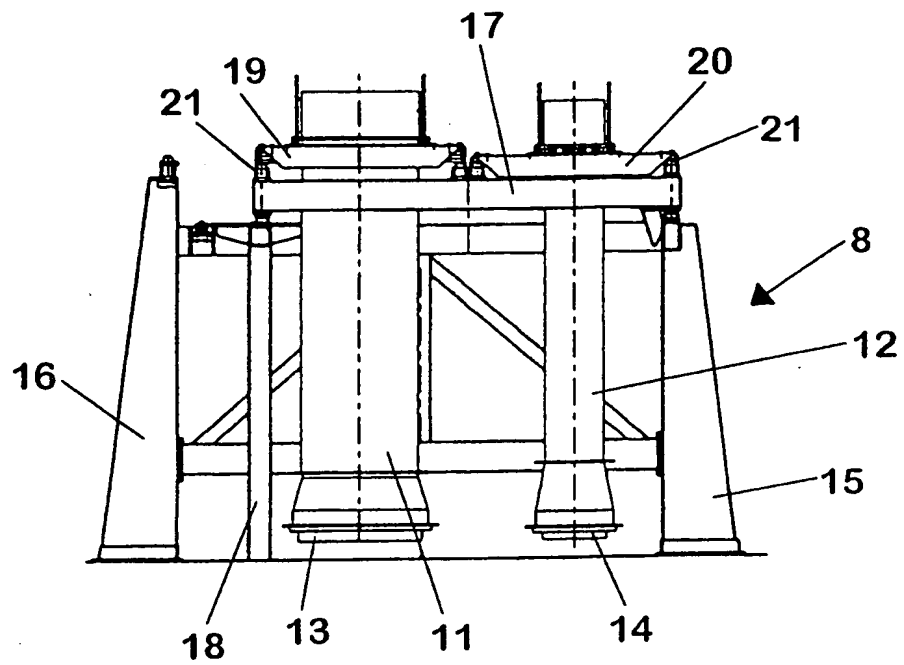


FIG. 3

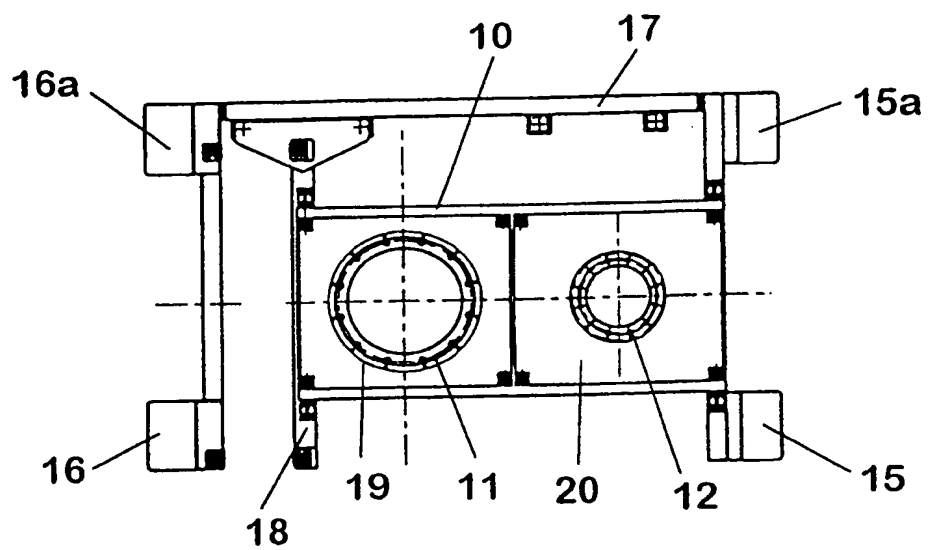


FIG. 4

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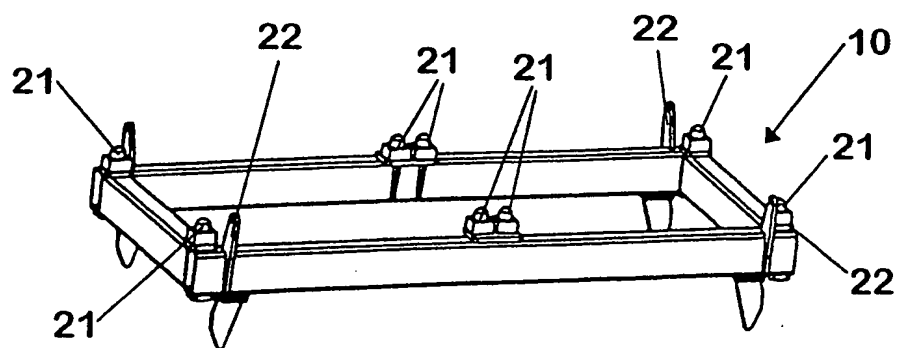


FIG. 5

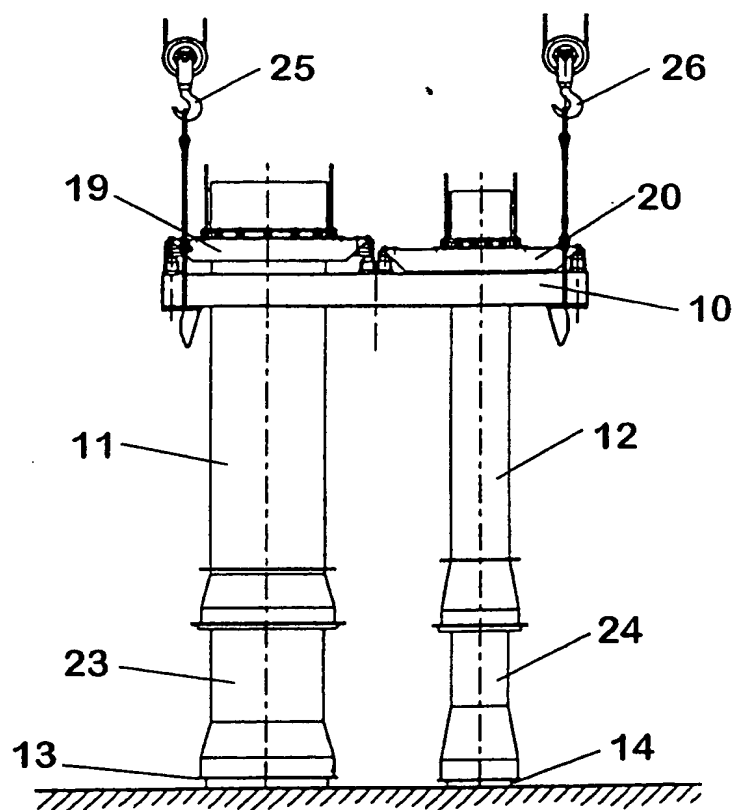


FIG. 6

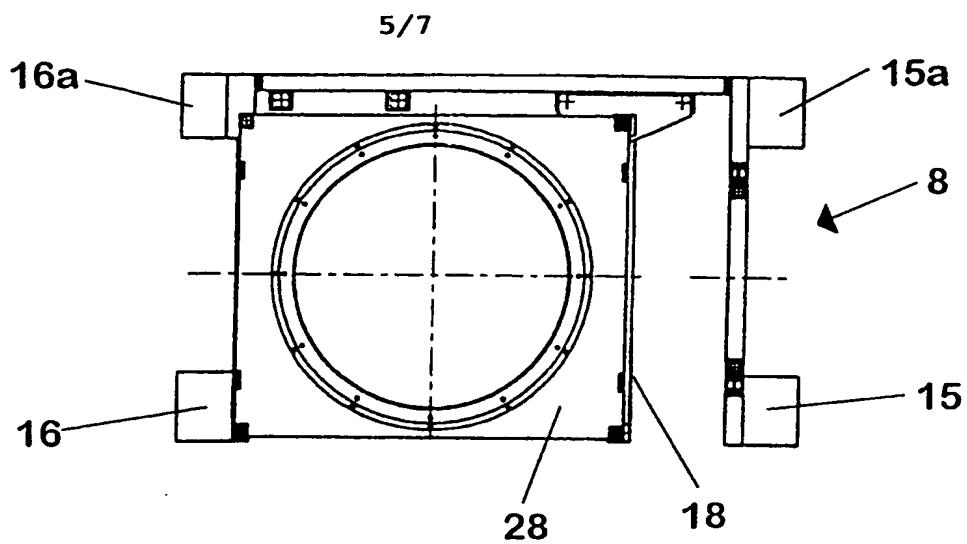


FIG. 7

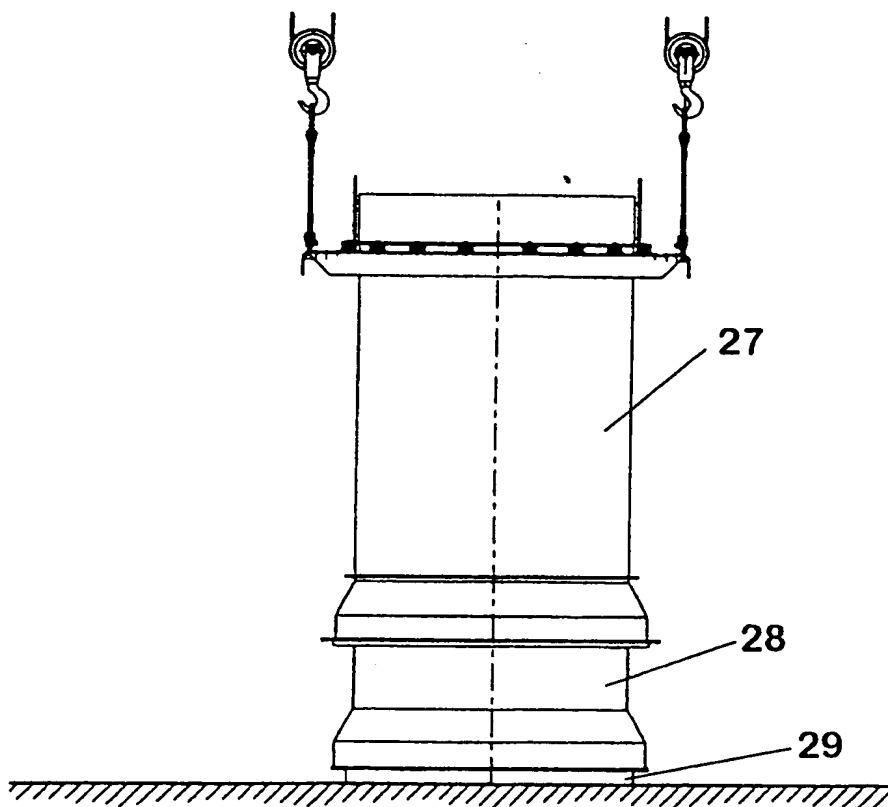


FIG. 8

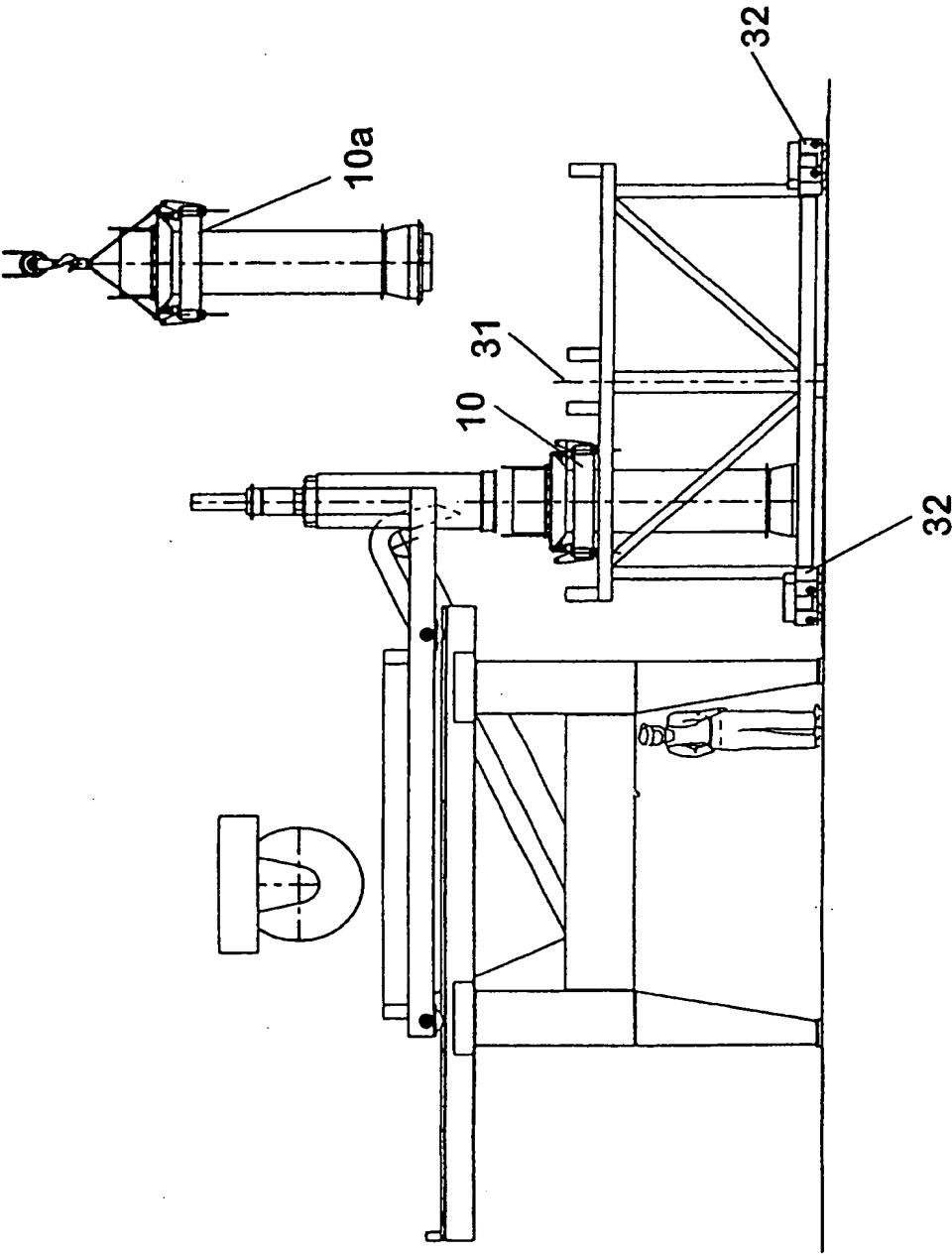


FIG. 9

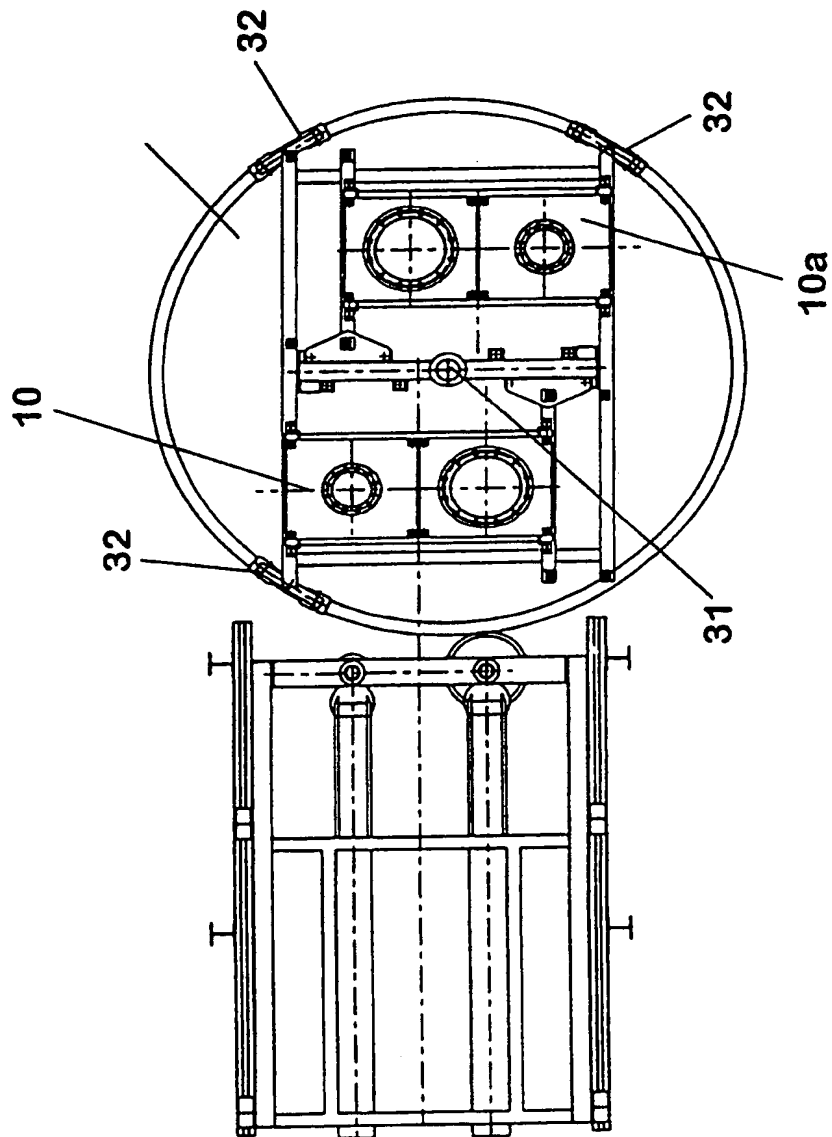


FIG. 10

INTERNATIONAL SEARCH REPORT

International application No.

PCT/DK 97/00258

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B28B 21/16 // B28B 21/82

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B28B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CH 388166 A (AKTIEBOLAGET OTTO-VERKEN), 15 June 1965 (15.06.65), figure 1, claim 1 --	1
A	CH 174023 A (I. WALLIMANN), 31 December 1934 (31.12.34), figure 1, claim 1 --	1-12
A	US 2926411 A (H. STEIRO), 1 March 1960 (01.03.60), figure 1 --	1-12
A	US 3119165 A (L.C. GOURLIE), 28 January 1964 (28.01.64), figure 8 -- -----	1-12

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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INTERNATIONAL SEARCH REPORT

Information on patent family members

02/12/97

International application No.

PCT/DK 97/00258

Patent document cited in search report			Publication date	Patent family member(s)	Publication date
CH	388166	A	15/06/65	NONE	
CH	174023	A	31/12/34	NONE	
US	2926411	A	01/03/60	NONE	
US	3119165	A	28/01/64	NONE	